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# Technical Note

## Brake Rectifiers and Wiring Diagrams



BM, BMG, and BE brakes contain two coils that operate via DC current. They also contain a rectifier that performs one or more of the following functions:

- Provides overvoltage protection
- Converts AC current to DC current
- Enables fast release and rapid reaction

All SEW rectifiers provide varistor overvoltage protection for either DC or AC voltage supply. When the input is DC, rectification is unnecessary. However when the input is AC, a half-wave rectifier converts it to DC by filtering one-half of the sine wave. The measured DC output voltage becomes 42% of the AC input. For example, 230V input becomes:

$$\mathbf{230V_{AC}\ x\ 0.42 = 96.6V_{DC}}$$

Fast release and rapid reaction are normally required for applications that involve high cycling, vertical lifting or high-speed conveying. Fast release allows the coil to energize as quickly as possible in order to remove the brake. It also prevents the motor from working against the brake, reducing brake wear. All rectifiers contain fast release, except the BG, BS, and BMS.

Rapid reaction allows the coil energy to dissipate as quickly as possible to stop the motor and to provide the smallest braking distance. All rectifiers (except the 24V BG) have the ability to perform rapid reaction if appropriately wired. For rectifiers mounted inside the motor terminal box, the wiring requires an auxiliary contact from the motor starter to connect terminals 4 & 5 on the rectifier. In lieu of an auxiliary contact, a UR relay or an SR relay can be used. Part numbers are listed below.

| Type | Voltage | Rated Motor Current in Y (high voltage) | Part Number |
|---|---|---|---|
| SR10 | — | 0.075 – 0.6 A | 826 462 7 |
| SR11 | — | 0.6 – 10 A | 826 761 8 |
| SR15 | — | 10 – 50 A | 826 762 6 |
| SR19 | — | 50 – 90 A | 826 246 2 |
| UR11* | 42 – 150 $V_{AC}$ | -- | 826 758 8 |
| UR15 | 150 – 500 $V_{AC}$ | -- | 826 759 6 |

* UR relay not available on BE5 brake and larger with brake voltage $\leq$ 120V

For detailed explanation on fast release and rapid reaction, see **Technical Note B-100**. For SR relay information and selection, see **Technical Note B-104.**



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## Rectifiers - Terminal Box

Unless otherwise requested, the standard rectifier is located inside the motor terminal box. The following chart shows the standard rectifier type for all brakes. Unlike the DT/DV motors, the DR motor can contain one of several brake sizes. Therefore, specific DR-motor frames are not shown.

| Brake Size | Motor Frame | AC Input | DC 24V Input |
|---|---|---|---|
| BMG05 – BMG4 | DT56, DR63, DT71 – DT100 | BG | BS24 |
| BE05 – BE2 | DR.. | | |
| BMG8 – BM62 | DV112 – DV225 | BGE | BSG |
| BE5 – BE20 | DR.. | | |
| BMG61, BMG122 | DV250 – DV280 | BGE | — |
| BE30, BE62 | DR.. | | |
| BE120 – BE122 | DR.. | iBMP 3.1 | — |

The specific rectifier size depends on the brake voltage and holding current, as listed below.

| Type | Supply Voltage | Max Holding Current ($A_{DC}$) | Color | Part Number |
|---|---|---|---|---|
| BG 1.2 (1) | 90 – 500 $V_{AC}$ | 1.2 | Black | 826 992 0 |
| BG 1.4 (2) | 230 – 575 $V_{AC}$ | 1.4 | Black | 827 881 4 |
| BG 1.5 | 150 – 500 $V_{AC}$ | 1.5 | Black | 825 384 6 |
| BG 2.4 (1) | 24 – 500 $V_{AC}$ | 2.4 | Brown | 827 019 8 |
| BG 3.0 | 24 – 500 $V_{AC}$ | 3.0 | Brown | 825 386 2 |
| BGE 1.0 (1) | 150 – 500 $V_{AC}$ | 1.5 | Red | 827 599 8 |
| BGE 1.4 (2) | 230 – 575$V_{AC}$ | 1.4 | Red | 827 882 2 |
| BGE 1.5 | 150 – 500 $V_{AC}$ | 1.5 | Red | 825 385 4 |
| BGE 3 | 42 – 150 $V_{AC}$ | 3.0 | Blue | 825 387 0 |
| BS24 | 24 $V_{DC}$ | 5.0 | Aqua | 826 763 4 |
| BSG | 24 $V_{DC}$ | 5.0 | White | 825 459 1 |
| iBMP 3.1 | 230 – 575 $V_{AC}$ | 2.8 | White + Red Top | 829 507 7 |

(1) Use with DT56, DR63 or IS plug connector
(2) Use with 575V brake voltage. Also use when 480V supply fluctuates above 500V.



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| | BG | BGE | BSR (BGE+SR) | BUR (BGE+UR) | BS | BSG |
|---|---|---|---|---|---|---|
| Standard Release (brake removed) | ● | | | | ● | |
| Fast Release (brake removed) | | ● | ●(2) | ●(2) | | ● |
| Standard Reaction (brake applied) | ● | ● | | | ● | |
| Fast Reaction (brake applied) | ●(1) | ●(1) | ●(2) | ●(2) | | ● |
| Heating function | | | | | | |
| For 24V DC brake voltage only (no rectification) | | | | | ● | ● |

(1) User must supply auxiliary contact from motor starter
(2) Not available if brake = BE5 (or larger) and brake voltage ≤ 120V

## BG Rectifier

The BG is a half-wave rectifier with overvoltage protection. It is supplied as standard for motor frame sizes 56 – 100. During starting, it provides normal brake release. During stopping, it produces normal reaction or rapid reaction, depending on the wiring. Rapid reaction is available by using an auxiliary contact from the motor starter.

The BG rectifier is recommended for applications with occasional braking and infrequent starting and stopping.

## BGE Rectifier

The BGE is a half-wave rectifier with overvoltage protection and additional electronics for fast release. It initially releases the brake very quickly with super-magnetization and then holds the stationary disc with reduced magnetization. This fast release minimizes the motor working against the brake, resulting in a cooler motor, less brake wear, and a higher cycling capacity.

During stopping, the BGE produces rapid reaction if appropriately wired with an auxiliary contact from the motor starter. However, to avoid using the auxiliary contact, SEW offers a package that includes the BGE in combination with an SR relay (BSR) or with a UR relay (BUR).

BGE is standard for motor frames DV112 and larger and for DR motors with brake size BE05 and larger. It is optional on smaller sizes, but is not available for DT56 and DR63. The BGE is recommended for the following:

- Application requires frequent starting/cycling
- Application includes vertical lifting/hoisting



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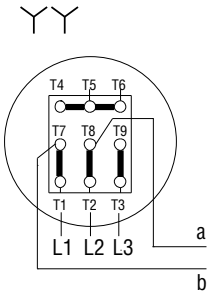
# Technical Note

## BG and BGE Wiring

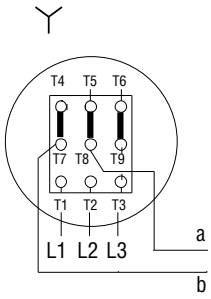
The following wiring diagrams apply to the BG and BGE rectifiers that receive power from the motor terminals. The rectifier may be wired for either normal reaction or rapid reaction. Notice that In Y/YY, the DR motor has only 6 terminals whereas the DT/DV motor has 9 terminals.

### DT/DV Motor YY/Y (230/460V)

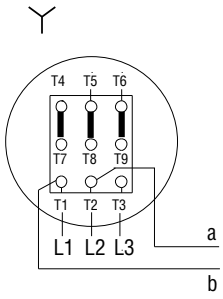
*Motor = Low Voltage*
*Brake = Low Voltage*



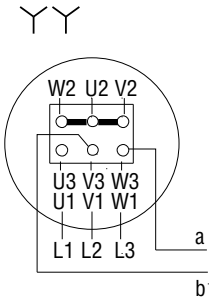

*Motor = High Voltage*
*Brake = Low Voltage*

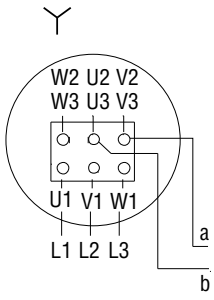


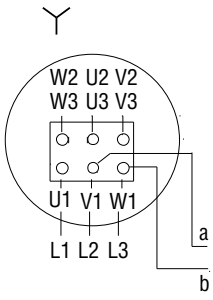

*Motor = High Voltage*
*Brake = High Voltage*



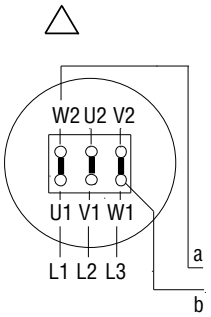

### DR Motor YY/Y (230/460V)

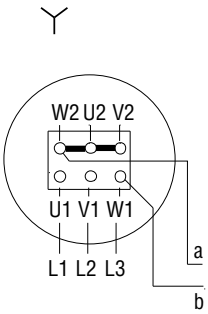


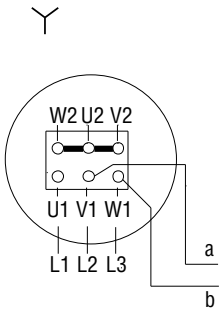



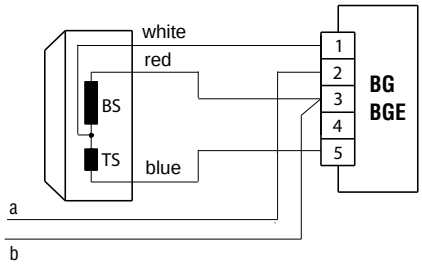

### All Motors Δ/Y (230/400V, 400/690V)



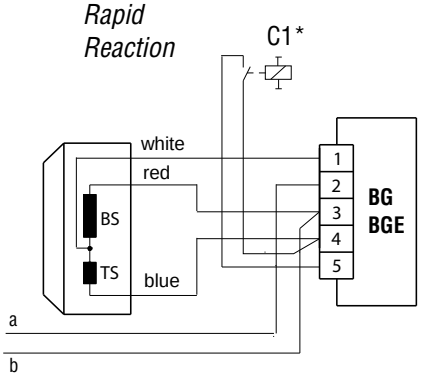




*Normal Reaction*




*Rapid Reaction*




*C1= Auxiliary contact on motor starter



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# Technical Note

## BSR Brake Control Package

The BSR is not a rectifier. Rather, it is a package that consists of the BGE rectifier and the SR relay for applications that require both fast release and rapid reaction.

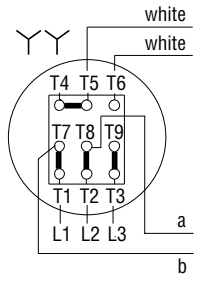
**BSR** = SR relay + BGE rectifier

The BSR brake control system uses the least amount of wiring. The SR relay mounts at the terminal box and connects directly to the motor terminal screws. Therefore, no additional wiring is required from the control panel to achieve rapid reaction. BSR is recommended for a single speed motor used without an inverter in an application requiring any of the following:

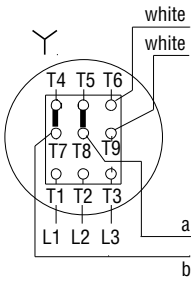
- Frequent cycling
- Minimal stopping distance with the highest accuracy
- Vertical lifting/hoisting

### DT/DV Motor YY/Y (230/460V)

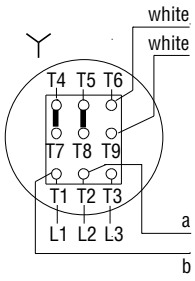
*Motor = Low Voltage*
*Brake = Low Voltage*



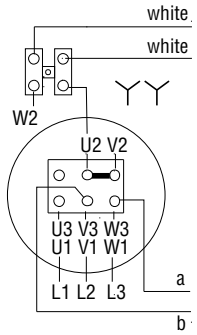

*Motor = High Voltage*
*Brake = Low Voltage*

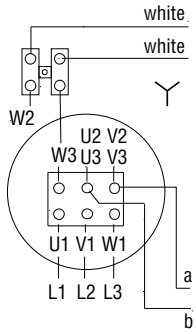


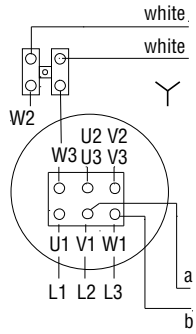

*Motor = High Voltage*
*Brake = High Voltage*



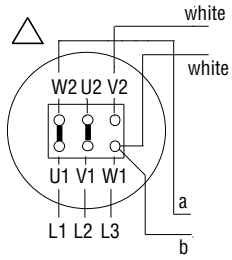

### DR Motor YY/Y (230/460V)

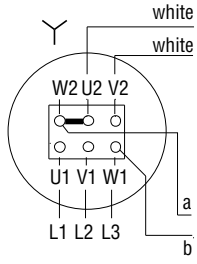


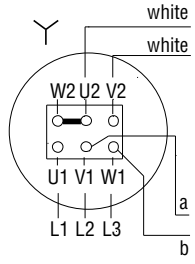



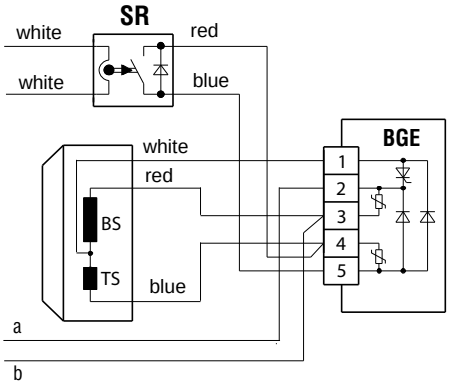




### All Motors Δ/Y (230/400V, 400/690V)






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## BUR Brake Control Package

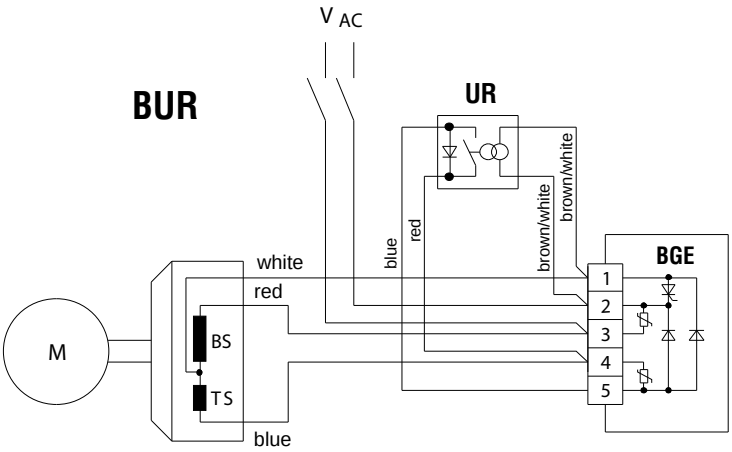
The BUR is not a rectifier. Rather, it is a package that consists of the BGE rectifier and the UR relay for applications that require both fast release and rapid reaction.

**BUR** = UR relay + BGE rectifier

The UR relay mounts at the terminal box, but receives its voltage source from the control panel. It is specially suited for two-speed motors or AC induction motors that operate from an inverter, since both applications require a separate voltage supply for the brake.

BUR is recommended when an inverter or a two-speed motor is used in an application requiring any of the following:

- Frequent cycling
- Minimal stopping distance with the highest accuracy
- Vertical lifting/hoisting

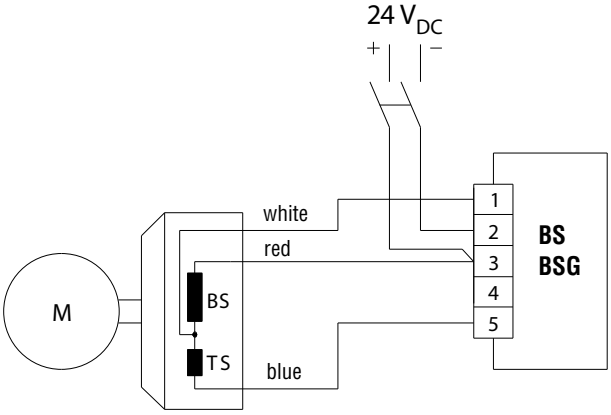



## BS Control Unit

The BS control unit provides varistor overvoltage protection without rectification. It is supplied as standard for a 24V DC brake on motor frame sizes 63 – 100. Like the BG, it provides normal brake release times. If the BS is not installed, the user should provide overvoltage protection.

## BSG Control Unit

The BSG control unit provides overvoltage protection and fast release, like the BGE. It is used with a 24V DC brake and is standard for motor frames 112 and larger. It is optional for motor frames 71 – 100. It may be installed either in the motor conduit box or in a control panel. If the BSG is not installed, the user should provide overvoltage protection.






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## Rectifiers - DIN Rail

Like any sensitive electronic device, a rectifier can be damaged with excessive heat. Thus, it should not be mounted inside the conduit box on brakemotors containing class H insulation, brakemotors that operate in an ambient temperature above **40°C**, or brakemotors with restricted air flow. In these conditions, an optional DIN rail mount rectifier should be used inside a control cabinet to prevent it from overheating.

| Type | Supply Voltage | Maximum Current ($A_{DC}$) | Color | Part Number |
|---|---|---|---|---|
| BMS 1.4 (1) | 230 – 575 $V_{AC}$ | 1.4 | Black | 829 830 0 |
| BMS 1.5 | 150 – 500 $V_{AC}$ | 1.5 | Black | 825 802 3 |
| BMS 3 | 42 – 150 $V_{AC}$ | 3.0 | Brown | 825 803 1 |
| BME 1.4 (1) | 230 – 575 $V_{AC}$ | 1.4 | Red | 829 831 9 |
| BME 1.5 | 150 – 500 $V_{AC}$ | 1.5 | Red | 825 722 1 |
| BME 3 | 42 – 150 $V_{AC}$ | 3.0 | Blue | 825 723 X |
| BMP 1.4 (1) | 230 – 575 $V_{AC}$ | 1.4 | Grey | 829 832 7 |
| BMP 1.5 | 150 – 500 $V_{AC}$ | 1.5 | Grey | 825 685 3 |
| BMP 3 | 42 – 150 $V_{AC}$ | 3.0 | Light Blue | 826 566 6 |
| BMP 3.1 (2) | 230 – 575 $V_{AC}$ | 2.8 | White + Red Top | 829 507 7 |
| BMH 1.4 (1) | 230 – 575 $V_{AC}$ | 1.4 | Green | 829 834 3 |
| BMH 1.5 | 150 – 500 $V_{AC}$ | 1.5 | Green | 825 818 X |
| BMH 3 | 42 – 500 $V_{AC}$ | 3.0 | Yellow | 825 819 8 |
| BMK 1.4 (1) (3) | 230 – 575 $V_{AC}$ | 1.4 | Turquoise | 829 833 5 |
| BMK 1.5 (3) | 150 – 500 $V_{AC}$ | 1.5 | Turquoise | 826 463 5 |
| BMK 3 (3) | 42 – 150 $V_{AC}$ | 3.0 | Pink | 826 567 4 |
| BMV | 24 $V_{DC}$ | 5.0 | White | 1 300 006 3 |

(1) Use with 575V brake voltage. Also use when 480V supply fluctuates above 500V.

(2) For DR315 motor only

(3) Requires 12 – 32 $V_{DC}$ control signal for brake relay



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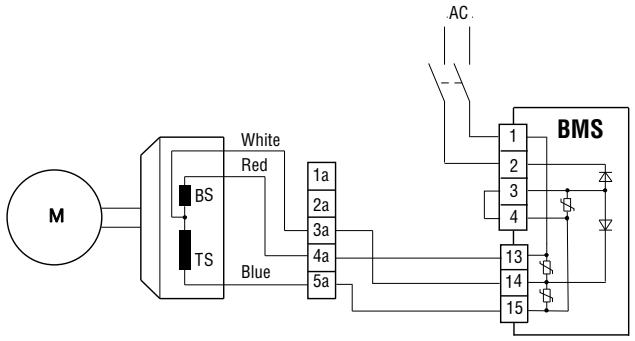
| | BMS | BME | BMH | BMP | BMK | BMV |
|---|---|---|---|---|---|---|
| Standard Release (brake removed) | ● | | | | | |
| Fast Release (brake removed) | | ● | ● | ● | ● | ● |
| Standard Reaction (brake applied) | ● | ● | ● | ● | | |
| Fast Reaction (brake applied) | ●(1) | ●(1) | ●(1) | ● | ● | ● |
| Heating function | | | ● | | | |
| For 24V DC brake voltage only (no rectification) | | | | | | ● |
| Requires 24V DC for brake control | | | | | ● | ● |

(1) User must supply auxiliary contact from brake contactor

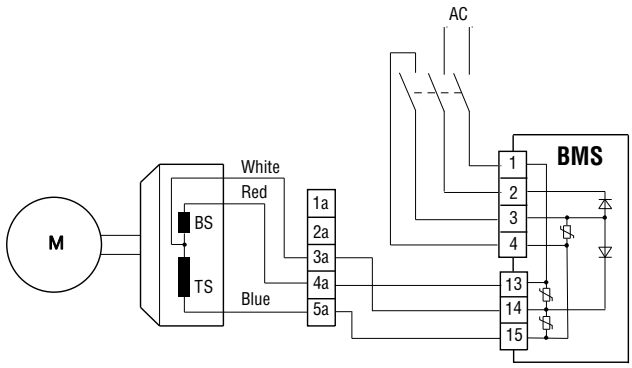
## BMS Rectifier

The BMS brake rectifier is a half-wave rectifier with overvoltage protection. It functions like the BG rectifier with normal brake release time. The BMS is primarily used when the ambient conditions of the motor do not permit the use of the BG rectifier in the motor terminal box. It is optional for motor frames DR63, DT71 – DT100, and DR motor brakes BE05 through BE2.

*Normal Reaction*




*Rapid Reaction*



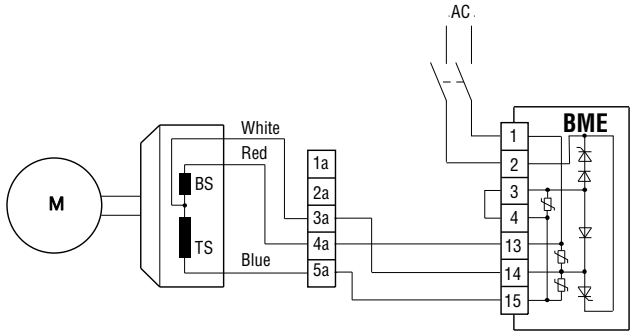



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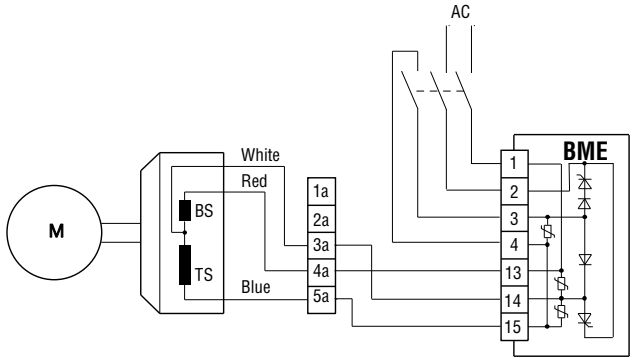
## BME Rectifier

The BME brake rectifier is a half-wave rectifier with overvoltage protection and electronic control for fast release. It functions like the BGE rectifier, but mounts in the control cabinet. It is available for all motors.

*Normal Reaction*




*Rapid Reaction*

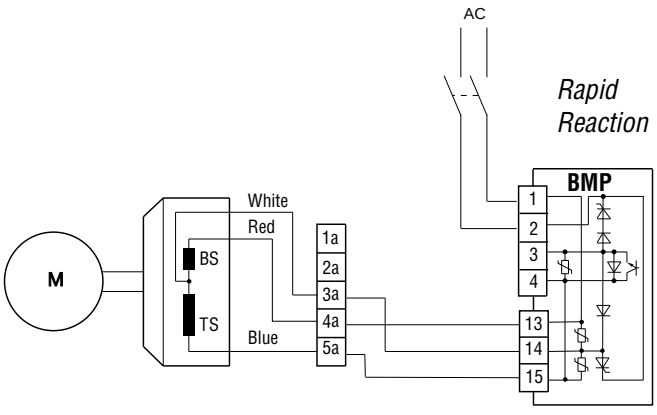



## BMP Rectifier

The BMP is a BME rectifier plus an integrated voltage relay. Therefore, it minimizes both the release time and the reaction time. It functions like the BGE brake rectifier and the UR voltage relay combined into one device. However, it mounts in the control cabinet. It is available for all motor frame sizes.

BMP is commonly used when the motor operates from an inverter not supplied by SEW. It requires three wires from the control panel to the motor. However, if ambient temperature allows for a terminal box rectifier (< 40°C), the user can save wiring by using a BUR package (BGE+UR) instead of a BMP. The BUR package requires only two wires from the control panel.

*Rapid Reaction*



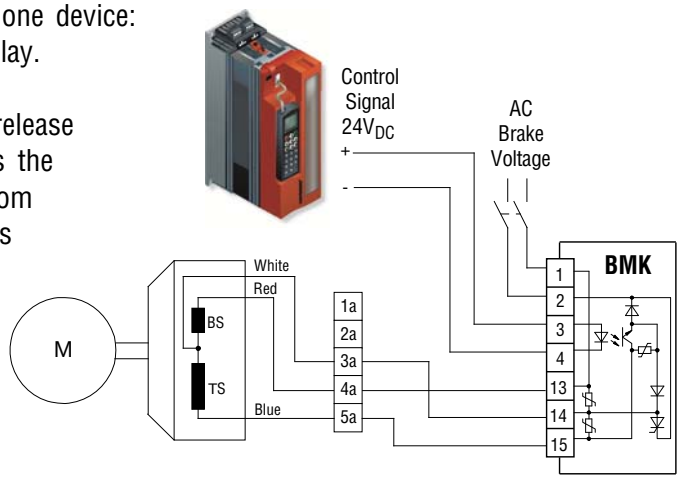



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## BMK Rectifier

The BMK rectifier combines three features into one device: fast release, rapid reaction, and a brake control relay.

Like the BMP and BUR, the BMK provides fast release and rapid reaction. However, the BMK switches the brake voltage via a built-in relay that operates from a $24V_{DC}$ control signal. The AC brake voltage is independent of the control signal and can be one of many available coil voltages between 42–500V. Since SEW inverters contain a $24V_{DC}$ output terminal specifically designed for a brake relay, the BMK is commonly used with an SEW inverter.



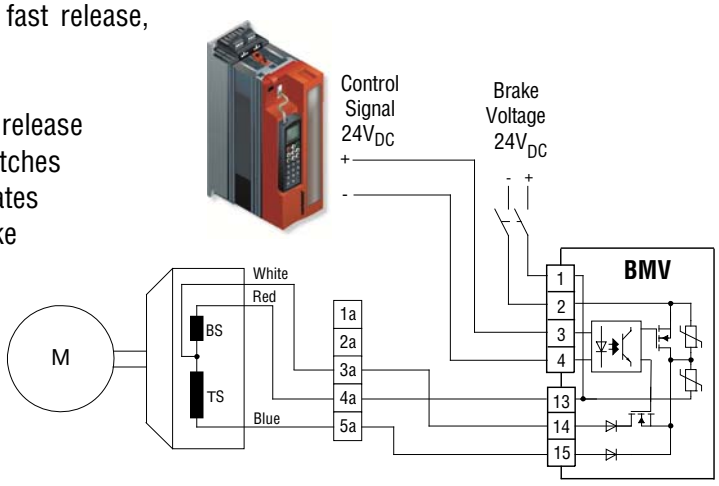

BMK benefits:

- Brake control using $24V_{DC}$ output signal from a PLC
- Brake control via the designated output terminal on an SEW inverter (MOVIDRIVE®, MOVITRAC®)
- Eliminates a separate brake control contactor in most PLC and inverter installations
- No arching or contacts to wear out – BMK is an electrical (solid state), not mechanical, relay

## BMV Rectifier

The BMV is used only with 24V DC brake voltage.
It combines three features into one device: fast release, rapid reaction, and a brake control relay

Like the BUR package, the BMV provides fast release and rapid reaction. However, the BMV switches the brake voltage via a built-in relay that operates from a $24V_{DC}$ control signal. The $24V_{DC}$ brake voltage is independent of the control signal. Since SEW inverters contain a $24V_{DC}$ output terminal specifically designed for a brake relay, the BMV is commonly used with an SEW inverter.




BMV benefits:

- Brake control using $24V_{DC}$ output signal from a PLC
- Brake control using the designated output terminal on an SEW inverter (MOVIDRIVE®, MOVITRAC®)
- Eliminates a separate brake control contactor in most PLC and inverter installations
- No arching or contacts to wear out – BMK is an electrical (solid state), not mechanical, relay



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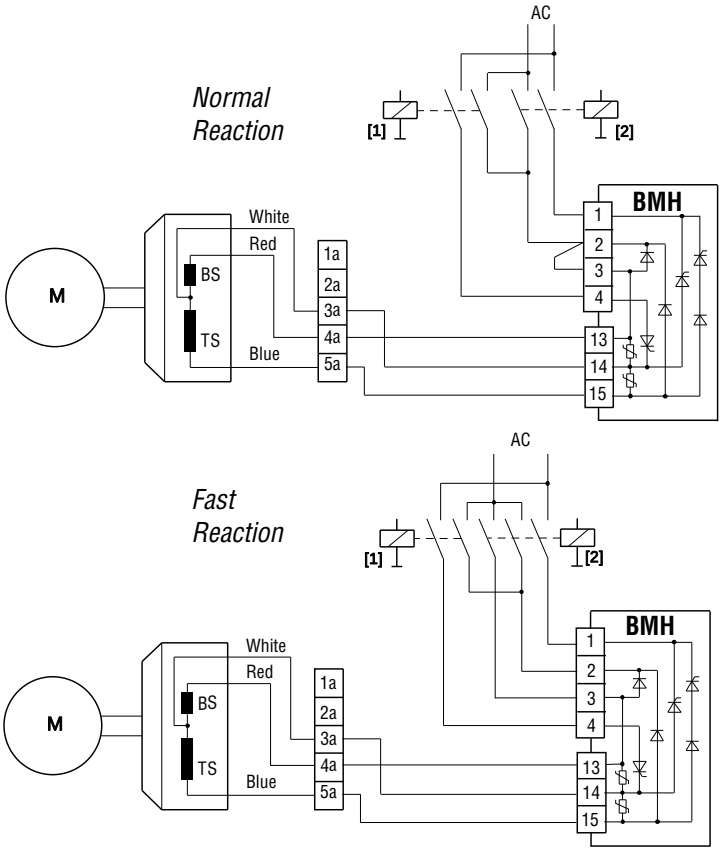
# Technical Note

## BMH Rectifier

For cold ambient temperatures, the BMH brake rectifier with a heating current is available for heating the brake while the motor is at rest. Electric heating is always recommended where moisture condensation followed by frost may occur or during long periods of rest in a wet, corrosive atmosphere.

The BMH brake rectifier has the same electronic circuitry as the BGE and thus provides the same short release times for the brake. However, the BMH is installed in the control cabinet and not the terminal box of the motor.

In the wiring diagram, contactors (1) and (2) are independent of each other. Contactor (1) controls heating and contactor (2) controls brake release.

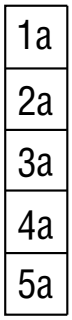



[1] Heating, [2] Braking

## Auxiliary Terminal Strip

When using a DIN rail rectifier that mounts in a control cabinet, the wires originating from terminals #13-15 on the rectifier must connect to a terminal strip inside the conduit box. Therefore, SEW automatically supplies terminal strip, #01830600, inside the conduit box for all brakemotor orders with a DIN-rail rectifier. See figure at right.

If the user decides to change to a cabinet mounted rectifier on an existing brakemotor that already contains a rectifier in the terminal box, he should purchase #01830600 with the DIN rail rectifier.



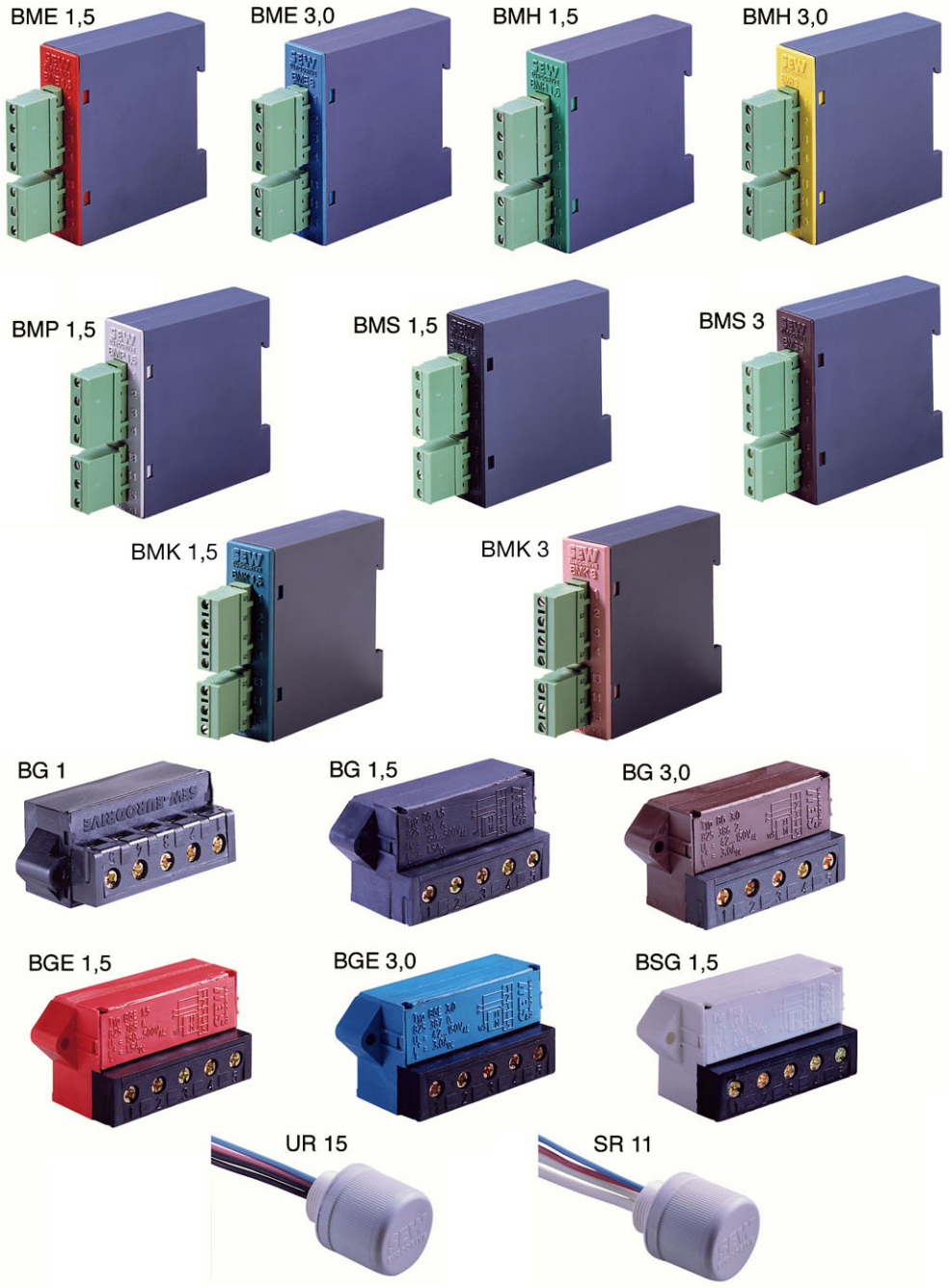

#01830600 – Terminal Strip



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# Technical Note

## Rectifiers and Relays – Visual Comparison






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